JPL AIRBORNE SCATTEROMETER AND RADIOMETER RESEARCH FOR OCEAN WIND REMOTE SENSING

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This paper provides an overview of the Jet Propulsion Laboratory's (JPL) airborne scatterometer and radiometer research program and discusses the science and aircraft performance requirements for ocean wind remote sensing. Ocean winds are a key driving force of momentum, humidity, and heat exchanges between the atmosphere and ocean. Measurements of ocean winds are critical for many meteorological and oceanographic studies and operational weather forecasts. The objectives of the JPL airborne scatterometer and radiometer research program are to develop the airborne testbed for ocean remote sensing techniques and to support NASA space missions for global ocean wind measurements. JPL has developed a Ku-band scatterometer (NUSCAT) and a dual-frequency (19 and 37 GHz) polarimetric radiometer (WINDRAD) to study the microwave signatures of ocean surfaces. The JPL NUSCAT was flown on the NASA C-130B in 1992 in the Surface Wave Dynamic Experiment (SWADE). The SWADE data set has been used to study the dependence of ocean backscatter on ocean wind velocity (speed and direction), wind stress, significant wave height, and sea surface temperature. The WINDRAD was developed to demonstrate a new technique using passive microwave radiometers for ocean wind velocity measurements. JPL has conducted a series of aircraft polarimetric radiometer flights over the National Data Buoy Center (NDBC) buoys deployed off the US west coast from 1993 to 1995 to determine the correlation of polarimetric brightness temperatures of sea surfaces with ocean wind speed and direction at 19 and 37 GHz from 45° to 6.5° incidence angles. Measured radiometric temperatures from all polarization channels showed wind direction dependence at 2 to 24 m/s. As a result, a spaceborne polarimetric radiometer has been included in the SEAWINDS follow-on mission. Our near-term plan is to use the combined NUSCAT and WINDRAD instrument to validate the performance of NASA scatterometer (NSCAT) launched in August 1996 on the Japanese ADEOS spacecraft. The combined instrument will be deployed on the NASA P-3 and a set of flights will be performed in October and November 1996 over the buoys in the Atlantic ocean. The combined data set will also allow us to explore the synergism of microwave scatterometer and radiometer data for the NASA Sea Winds mission from 1999 to 2002. In addition to its supporting role and use as a technology test bed for space missions, the airborne microwave system allows a high resolution and more frequent mapping of ocean fronts and eddies, weather systems, and coastal oceans, complementary to the synoptic view of oceans provided by spaceborne instruments. In concert with the purpose of this workshop, this paper will summarize the science requirements on aircraft scatterometer and radiometer measurements for the aforementioned applications and discusses the resulting key requirements on aircraft performance.